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# Comparative Study of FEV1/FVC RATIO AND PEFR in Relation to Body Mass Index in Young Adult - A Cross-Sectional Study

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## ABSTRACT

**Background:** The aim of the study was to study the effect of body mass index on pulmonary function test parameters like FVC, FEV1, FEV1/FVC ratio and PEFR in the normal weight and overweight young adults. **Methods:** In the present study 182 subjects were included, aged between 18 yrs-30 yrs after applying inclusion and exclusion criteria. **Results:** The Mean and Standard Deviation for PEFR in the normal-weight group is 73.95±23.49 and it is 63.78±21.07 in the overweight group and is statistically significant (p=0.002).**Conclusion:** Obesity does not have a direct effect on the spirometry test results (except PEFR) among healthy non-smoking adults and any such effect needs to be explained by underlying respiratory diseases.

***Keywords:*** Obesity, Body Mass Index, PEFR, Spirometry.

## INTRODUCTION

Obesity has been reported as a global epidemic and is defined as an abnormal and excessive collection of fat in the body. Spirometry is the most common pulmonary function test measuring lung functions, especially the measurement of amount and flow speed of air that can be inhaled or exhaled. Obesity is defined as an abnormal and excessive collection of fat in the body and is considered to be an important global health hazard and has been linked to increased incidence of cardiovascular diseases, hypertension, a metabolic disorder like diabetes mellitus, hyperlipidemia and pulmonary dysfunction.[1,2] Clinical obesity is also associated with impairment of lung function. Body mass is modulated from birth to adulthood by physiological mechanisms such as balancing intake, caloric expenditure and energy reserves. Hyper caloric diet and sedentary lifestyle have resulted in the development of obesity in younger populations. The development of obesity triggers a vicious cycle in which subjects become obese, and the systemic repercussions of their disease process make them intolerant to exercise; as such, they become more sedentary, which promotes an additional weight gain. Multisystem dysfunction, an entity previously observed only in adults, has become more common among children and adolescents, resulting in physical exercise intolerance and increasing the prevalence of obesity, which affects the cardiorespiratory system.[3,4] Body mass index (BMI) is a simple index of weight for a height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m2). BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages. The normal BMI range is between 18.5 and 24.99 kg/m2. As per the WHO definition, BMI greater than or equal to 25 is overweight and a BMI greater than or equal to 30 is obesity.[5] WHO classification includes an additional subdivision of BMI 35.0-39.9 in recognition of the fact that management options for obesity differ above BMI of 35. Increased BMI is a major risk factor for non-communicable diseases like cardiovascular diseases, mainly diseases of the heart and stroke, musculoskeletal disorders like osteoarthritis and some cancers like that of endometrial, breast and colon. Obesity can cause various deleterious effects to respiratory function, such as alterations in respiratory mechanics, reduced chest wall compliance, increased work of breathing, decrease in respiratory muscle strength and endurance, decrease in pulmonary gas exchange, lower control of breathing, and limitations in pulmonary function tests and exercise capacity.[6-10] These changes in lung function are caused by extra adipose tissue in the chest wall and abdominal cavity, compressing the thoracic cage, diaphragm, and lungs. The consequences are a decrease in diaphragm movement, a decrease in lung and chest wall compliance, and an increase in elastic recoil, resulting in a decrease in lung volumes and an overload of inspiratory muscles.[11] Severe obesity

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may be associated with obstructive sleep apnea and the obesity hypoventilation syndrome' with attenuated hypoxic and hypercapnic ventilatory responses. These changes are worsened by an increase in the BMI.[11] There is not much available data in India about the relationship between respiratory indices to BMI in young adults. Therefore, we aim to study the effects of obesity on spirometry tests among healthy young adults in Northern India. Our study
is limited to the spirometry part of PFT because spirometry tests are considered to be the initial screening tool for pulmonary diseases and are the most widely used tests.

**Aims and Objective**

The purpose of this study was to study the effect of body mass index on pulmonary function test parameters like FVC, FEV1, FEV1/FVC ratio and PEFR in the normal weight and overweight young adults.

## MATERIALS AND METHODS

The study was carried out in the Department of Physiology at Patna Medical College and Hospital. Approval for this study was taken from the ethical committee. It was a cross-sectional study to compare the respiratory indices in relation to BMI in age groups of 18-30 years. The subject of the proposed study was selected randomly from medical students, nursing staff, lab technicians in age groups of 18-30 yrs.

- **Now the study group was divided into group A and group B according to BMI.**

**Group A:** Normal weight (control) - 18.50 – 24.99 kg/m2
**Group B:** Over weight (cases) - >25.00 kg/m2

**Inclusion Criteria**

1) Subjects who have given written consent
2) Age between 18-30 years,
3) Non-smoker
4) Subjects falling within the range of normal weight, underweight and Overweight
5) Healthy individuals free from any systemic disease.

**Exclusion Criteria**

Subjects having physical deformities of the chest wall, subjects suffering from respiratory diseases such as chronic obstructive pulmonary disease, bronchiectasis, interstitial lung disease.

**Statistical Analysis:**

The data was obtained in both study and a control group was expressed as the mean ± standard deviation. Statistical analysis was done to compare the mean between the two groups with the help of statistical software SPSS 17.0. The p-value of < 0.05 was considered as statistically significant. Data were analyzed using unpaired T-test (α error set at 5%).

## RESULTS

In the present study, 182 subjects were included, aged between 18 yrs-30 yrs after applying inclusion and exclusion criteria. The spirometric parameters which were studied with respect to BMI include FEV1, FVC and FEV1/FVC ratio.

**Table 1: showing a comparison between normal weight and overweight group in respect to FVC, FEV1, FEV1/FVC, PEFR**

| Para meters | Normal weight | Overweight | Normal weight | Overweight | Normal weight | Overweight | | |
|---|---|---|---|---|---|---|---|---|
| | N | N | Mean | Mean | Std .Dev. | Std .Dev. | t-value | p- value |
| FVC(L) | 78.00 | 104.00 | 81.65 | 81.88 | 18.55 | 19.39 | -0.081 | 0.936 |
| FEV1(L) | 78.00 | 104.00 | 82.01 | 83.84 | 29.37 | 24.46 | -0.456 | 0.649 |
| FEV1/FVC | 78.00 | 104.00 | 102.64 | 105.41 | 31.24 | 25.56 | -0.658 | 0.511 |
| PEFR(L/S) | 78.00 | 104.00 | 73.95 | 63.78 | 23.49 | 21.07 | 3.067 | 0.002 |

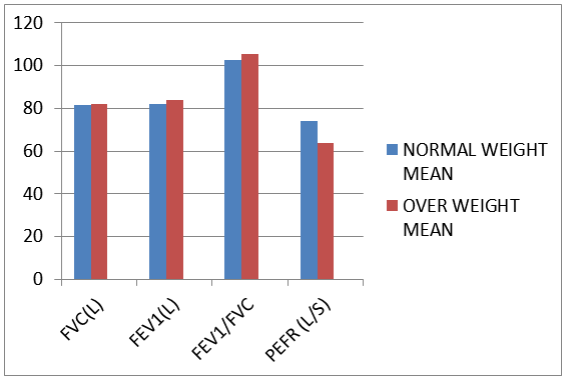


**Figure 1: Bar Diagram showing comparison between normal weight and overweight group in respect to FVC, FEV1, FEV1/FVC, PEFR**

The Mean and Standard Deviation for FVC in the normal weight group is 81.65±18.55 and it is 81.88±19.39 in the overweight group and statistically insignificant (p=0.936). The Mean and Standard Deviation for FEV1 in the normal-weight group is 82.01±29.37 and it is 83.84±25.56 in the overweight group and statistically insignificant (p=0.649). The Mean and Standard Deviation for the FEV1/FVC ratio in the normal-weight group is 102.64±31.24 and it is 105.41±25.56 in the overweight group and statistically insignificant (p=0.511). The Mean and Standard Deviation for PEFR in the normal weight group is 73.95±23.49 and it is 63.78±21.07 in overweight group and is statistically significant (p=0.002).

## DISCUSSION

The result shows that there were no significant differences between the overweight and normal-weight subjects in FEV1, FVC, FEV1/FVC ratio however there was a significant difference between the two groups in regard to PEFR. PEFR is the maximum flow rate achieved by the patient during the forced vital capacity maneuver beginning after full inspiration and starting and ending with maximal expiration. Overweight subjects had lower PEFR values than normal-weight subjects. Low PEFR is due to increase in total respiratory and airway resistance with obesity. In this study, the Mean and Standard Deviation for PEFR in the normal-weight group is 73.95±23.49 and it is 63.78±21.07 in the overweight group and is statistically significant (p=0.002). Our study has consisted with the study done by Mohammed Al Ghobain et al who studied the effect of obesity on the spirometry test among non-smoking adults. They found that there was a significant difference between the two groups in regard to PEFR. The obese subjects had lower PEFR values than the non-obese subjects. The low PEF in obese subjects can be explained by an increase in total respiratory resistance and airway resistance with obesity. The higher airway resistance, the higher BMI and subsequently, the lower PEF.[12] The result of the present study was consistent with the study done by Farida El-Baz, 24 on 30 children within the age group between 6-16 years who were categorized into simple obese and normal weight based on BMI percentile. They observed that there was a statistically significant lower value of PEFR in obese children than the control group. They further stated that the lower PEFR indicated that there was small airways obstructive defect. They suggested both obesity itself and the pattern of body fat distribution have independent effects on ventilatory function. They hypothesize that obesity affects respiratory function by multiple mechanisms in addition to its direct mechanical effect on the abdominal and chest wall as fat was a metabolically active tissue. The lower value of PEFR could be linked to the mechanical effect of obesity on the diaphragm and also because of fat deposition between the muscles and ribs that can lead to an increase in metabolic demands and work of breathing. The low PEFR in the obese subject can be explained by an increase in total respiratory resistance and airway resistance with obesity. The higher BMI, the higher airway resistance and subsequently, the lower PEFR.[13] The most important change in pulmonary functions in obesity is a decrease in lung compliance due to the increased weight of the chest wall resulting in a decrease in the lung functions which subsequently leads to an increase in the work of breathing. The deposition of fat on the chest wall may impede the expansion of the rib cage, through a direct loading effect or by altering the inter-costal muscle function.

## CONCLUSION

Obesity does not have a direct effect on the spirometry test results ( except PEFR) among healthy non-smoking adults and any such effect needs to be explained by underlying respiratory diseases. We are also of the same opinion as Md. Al Ghobain that the physicians who use spirometry test in their practice to search for alternative diagnosis in case of findings of abnormal spirometry tests result among obese individuals as these abnormal findings should not attribute to obesity.

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